

Degradation behavior at elevated temperature of $\text{LaNi}_{5-x}\text{Sn}_x\text{H}_z$ for x between 0.20 and 0.25

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Tin (Sn) substitution for a portion of the nickel in LaNi_5 has been shown [1] to alter many of the thermodynamic properties of the resulting hydride phase as evident from the pressure-composition-temperature (PCT) isotherms for these alloys. Namely, Sn reduces the plateau pressures, hydrogen storage capacity, and hysteresis ratio and increases the enthalpy of formation. Furthermore, tin has also been found to significantly enhance the stability of the hydride phase during both thermal cycling [2] under hydrogen gas and electrochemical cycling [3].

Recent systematic studies of the hydriding behavior of $\text{LaNi}_{5-x}\text{Sn}_x\text{H}_z$ alloys with Sn contents in the range $0.20 < x < 0.25$ have revealed changes in the PCT isotherms measured above 450K. Some loss in reversible capacity was observed along with reductions in the plateau pressures and hysteresis ratios while the slopes of the plateau became greater. These changes are indications of degradation processes and increased disorder within the alloy structure. Additional experiments were performed for long periods (i.e., >1000 hours) at elevated temperatures and hydrogen pressure to produce further degradation in the PCT isotherms. A full description of these measurements will be presented.

The impact of alloy composition and preparation method on the crystal lattice properties before and after hydrogen reactions has been studied using high-resolution x-ray powder diffraction with synchrotron radiation. Changes in these x-ray diffraction patterns will be correlated to various structural modifications within the alloy induced by the hydrogen reaction and aging treatments.

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2. R. C. Bowman, Jr., J. Alloys Compounds 217 (1995) 185.
3. B. V. Ratnakumar, J. Electrochem. Soc. 143 (1996) 2578.